APPENDIX A

COMMENTS ON THE U.S. ENVIRONMENTAL PROTECTION AGENCY'S PROPOSED NATIONAL AMBIENT AIR QUALITY STANDARDS FOR PARTICULATE MATTER

Both the State of California and U.S. Environmental Protection Agency (U.S. EPA) have established ambient air quality standards. State and national ambient air quality standards set legal maximum limits on the level of an air pollutant in the outdoor (ambient) air necessary to protect public health and the environment. The health-based national ambient air quality standards (NAAQS) are designed to protect public health and must include an adequate margin of safety. Health protection is the only legal basis for the selection of these standards.

The NAAQS are established through a carefully considered process that is designed to use the best scientific information available, with an opportunity for public input, as well as review by recognized independent scientific experts--the Clean Air Scientific Advisory Committee (CASAC). California's health-based state ambient air quality standards are set independently by the California Air Resources Board, also based solely on a review of the science. A comparison of the current and proposed federal particulate matter (PM) standards and current California standards is presented in Table A-1.

In the case of PM, two indices have been proposed--PM2.5 and PM10 with two averaging periods each, as shown in the Table A-1. These indices define the diameter of the largest particles considered, in micron units. For example, a PM10 index means that the mass of particles equal to and smaller than 10 microns is considered. The PM2.5 proposal would apply to particles 2.5 microns and smaller. The level of a standard is typically expressed as units of mass per unit volume; in the case of particulate matter this is micrograms per cubic meter (µg/m3). The averaging periods proposed for PM are 24-hour and one year (annual). The final parameter, form, is more complex. The form represents the statistical expression of a given standard. For PM, form factors include how ambient monitoring data is to be aggregated across multiple stations in a region (spatial averaging) and how many times a given level may occur (number or percent of time the specified concentration is reached or exceeded over the averaging period of the standard).

Table A-1 Particulate Matter Standards			
Index	**Averaging Time**	**Level**	**Form**
PROPOSED FEDERAL STANDARDS			
PM2.5	24-Hr	50 µg/m3	98th percentile, 3-yr average, <u>highest monitor</u>
	Annual	15 µg/m3	Arithmetic mean, 3-yr average, <u>monitors averaged</u>
PM10	24-Hr	150 µg/m3	98th percentile, 3-yr average, <u>highest monitor</u>
	Annual	50 µg/m3	Arithmetic mean, 3-yr average, <u>highest monitor</u>
CURRENT FEDERAL STANDARDS			
PM10	24-Hr	150 µg/m3	1 expected exceedance per year, on average, <u>highest monitor</u>
	Annual	50 µg/m3	Arithmetic mean, 3-yr average, <u>highest monitor</u>
CALIFORNIA STANDARDS			
PM10	24-Hr	50 µg/m3	Statistical equivalent to 1 exceedance per year, on average, <u>highest monitor</u>
	Annual	30 µg/m3	Annual Geometric mean, <u>highest monitor</u>

There is new information on respirable particulate matter from health and ambient monitoring studies. Important studies have been performed since the current federal PM10 standards were last established in 1987. These studies consistently find that exposures to ambient levels of PM10, which includes PM2.5, adversely impact health. These adverse effects include increased respiratory illness, hospitalizations, and mortality rates.

The health effects data do not point to a clear, no-effects or threshold level for PM (either 2.5 or 10) for these effects. Traditionally and under the federal Clean Air Act, such a no-effects level provides the basis to begin air standards considerations. Once a no-effects or safe level is identified, a margin of safety is added to assure adequate health protection that accounts for uncertainty. The absence of a no-effects level may be because no safe level exists (i.e., there is no threshold below which no effects occur), because methods to identify a safe, no-effects threshold are lacking, or because the studies have not been done that could identify a "safe" level.

Given the absence of an identifiable no-effect threshold, risk assessment techniques were used to select the proposed PM2.5 standards. Inherent in this approach is the need to accept a certain level of public health risk. The Administrator does not fully discuss how the risk assessment was incorporated into the proposal. However, the results of the risk assessments demonstrate that it is likely that substantial adverse health effects will continue to occur at the levels proposed for the PM2.5 standards.

Proposed Standards for PM2.5

The proposed PM2.5 standards would provide increased public health protection, beyond the current federal PM10 standards. This size fraction, often referred to as "fine particles," is composed largely of materials that are either directly emitted by combustion or formed by atmospheric conversion of products of combustion. These particles have easy access to the deep lung and have been associated with increases in illness and premature mortality in exposed populations. Human health studies indicate that the health impacts of this class of pollutant should be considered. This can be done with California's approach of adopting a health-protective PM10 standard or through a combination of PM2.5 and PM10 standards.

The proposal to establish an annual average PM2.5 standard is based on the best available health studies. In these studies, the low end of values with demonstrated health effects is 12 µg/m3. This value is documented in U.S. EPA's Staff Paper and Criteria Document. Based on these studies, the proposed value (15 µg/m3) would allow significant levels of increased frequency and severity of illness, and premature mortality.

The proposed 24-hour average PM2.5 standard of 50 µg/m3 alone, or in combination with the proposed 24-hour PM10 standard, is not as health protective as California's current 24-hour PM10 standard. California's 24-hour PM10 standard is 50 µg/m3; since PM2.5 is a subset of PM10, a PM2.5 standard must be lower than 50 µg/m3 in order to provide equivalent protection.

The 24-hour standard should be based on the explicit prevention of effects found to occur over the 24-hour time base. The prevention of health effects resulting from peak exposures is essential in California and other parts of the country which experience such peaks. The Staff Paper and Criteria Document include consideration of numerous studies that report adverse health impacts, including increased daily mortality, hospital admissions and respiratory symptoms when PM2.5 levels are within the 30-40 µg/m3 range. These health studies support a 24-hour value not to exceed 40 µg/m3.

Proposed Standards for PM 10

The proposed addition of PM2.5 standards, regardless of the level selected, will not provide the explicit protection from "coarse" particle exposures provided by the California PM10 standards. The coarse particle component of PM10 consists of respirable particles that are between 2.5 and 10 microns in diameter. Respiratory effects found in PM10 health studies could be mediated by either coarse or fine particles. The Staff Paper states, "Although much of the recent epidemiology suggests greater effects from fine particles, it is premature to ascribe all of the effects observed in PM10 studies to fine particles."

In fact, several studies suggest a role for coarse particles in exacerbating upper respiratory problems, such as asthma and bronchitis. For example, two studies in which ambient particle mass was dominated by the coarse fraction found associations with lower respiratory conditions (Gordian et al., 1996, Hefflin et al. 1994). Acute bronchitis symptoms in children were found to be more strongly associated with coarse particulate than PM2.5 in a study by Dockery et al. (1989). Schwartz et al. (1994) reported that respiratory symptoms were more strongly associated with PM10 than PM2.5 or sulfate. U.S. EPA has de-emphasized the potential effects of coarse particles, even though the available epidemiologic evidence does not imply that acute exposure to coarse particles is benign and without effect.

Based on the available science, it is difficult to effectively distinguish between the impacts of fine and coarse particles, especially with respect to health outcomes affecting the airways (the bronchi and bronchioles). Though the epidemiologic data indicate that exposures to low concentrations of ambient PM10 have been consistently linked with respiratory air-way related diseases, it is not clear whether the relationship is stronger for coarse or fine particles, or whether the associations are of roughly equal magnitude. Given the current state of the science, it is important to continue to focus on reducing exposure to a pollutant indicator (PM10) known to be linked with airway conditions, such as asthma and bronchitis.

Of the PM10 standards, the 24-hour standard is the most important in addressing acute health effects. The 24-hour PM10 values found in western states, such as California, may at times be quite high. These levels are not always associated with high PM2.5 values. The available California data show that the PM2.5 component of PM10 may range from less than 25 to over 90 percent at different times and locations. High PM10 days may not be high PM2.5 days; thus, a separate health-protective 24-hour PM10 is needed. When the California Air Resources Board established its PM10 standard it found 50 µg/m3 to be a health-protective value. A review of recent findings strongly supports the merit of this determination, but suggests that a 50 µg/m3 level provides little, if any, margin of safety--a level of no more than 40 µg/m3 is supported by the results of recent studies. In addition, the proposed annual average PM10 standard of 50 µg/m3 is higher than California's annual PM10 standard of 30 µg/m3. The studies support a level of 30 µg/m3 for an annual standard.

Proposed "Form" of Standards

U.S. EPA proposes to use new approaches for the "forms" of the PM10 and PM2.5 standards. The form of a standard defines how attainment is measured and affects the amount of air quality improvement needed. The form of a standard is important because it, together with the level and averaging time for a standard, determines the degree of health protection. The new forms decrease the public health protection afforded by the proposed standards. The most health-protective form of the standards would allow no more than one exceedance per year, on average, (or the statistical equivalent) and not include the proposed provisions for spatial averaging.

24-Hour Standards

While level of the proposed PM10 standard remains unchanged at 150 µg/m3, U.S. EPA has proposed to change the current "one expected exceedance" form to a "98th percentile" form, that is, a three-year average of the 98th percentile concentrations. U.S. EPA has also proposed a 98th percentile form for its 24-hour PM2.5 standard. Use of the 98th percentile would allow the highest measured values to be ignored when determining the level of emission reductions needed to attain the standard, reducing the health protection that the standard would otherwise provide.

To understand what is meant by a 98th percentile form, it is useful to look at how many times it would allow an area to exceed the standard. For example, instead of allowing a PM10 nonattainment area to exceed the standard just once a year, on average, the 98th percentile form would allow more than six exceedances every year to be excused (based on daily sampling). With many more exceedances allowed, the proposed form substantially relaxes the current 24-hour PM10 standard. With a 98th percentile form, the proposed PM2.5 standard is also less protective than it would be with a one exceedance, or an equivalent form. The proposed approach would also make the standards unnecessarily complex without significantly improving the statistical stability.

We analyzed California air quality monitoring data to investigate the extent to which the proposed form excuses peak concentrations. One way to gauge the effect of relaxing the form of the 24-hour standard is to see how it affects the way a given area's air quality data compare to the standard. To compare an area's air quality data to the standard, we need to calculate a "design value," an area's peak particulate matter concentration after excusing the number of concentrations allowed by the form. Using 1993-1995 data from ARB's data base, we calculated "design values," following the procedures specified by U.S. EPA, under the current and the proposed form of the 24-hour PM10 standard to compare the forms to one another. Table A-2 presents a comparison of the current and proposed PM10 standard, by displaying the percent by which the 98th percentile is lower than the peak monitored concentrations.

In all cases, the 98th percentile design values are much lower than peak monitored concentrations. In Table A-2, the 98th percentile values, using the proposed form of the

PM10 standard, range from 8 percent to 68 percent lower than the peak monitored values. On average, the design values calculated using 1993-1995 California air quality data are about a third lower.

Table A-2
Comparison of Current and Proposed "Form" of 24-Hour PM10 Standards
(Based on All Qualifying Data for 1993 - 1995)

California Air Basin	Amount by Which the 98th Percentile (proposed standard) is Below the Peak Monitored Value (current standard)
Great Basin Valleys	68 %
Lake County	35 %
Mountain Counties	33 %
North Coast	25 %
North Central Coast	18 %
South Coast	22 %
South Central Coast	54 %
San Diego	8 %
San Francisco Bay Area	21 %
San Joaquin Valley	47 %
Salton Sea	50 %
Sacramento Valley	34 %

Qualifying data satisfy the appropriate "completeness" criteria. Note data from the Lake Tahoe, Mojave Desert, and Northeast Plateau Air Basins do not meet completeness criteria

Annual PM2.5 Standard

U.S. EPA proposes "spatial averaging" for the annual PM2.5 standard. Instead of using the average value at the monitor showing the highest readings in an area, U.S. EPA proposes to average the values from multiple monitors across a region. Spatial averaging combines high and low monitors to calculate a theoretical average that does not portray the level of pollution that people living near the high monitor actually breathe. The net effect of combining concentrationsfrom the monitors located in areas with the highest PM2.5 levels, with those in areas with lower PM2.5 levels, is to produce lower, spatially-averaged values. This approach would overlook the exposures of people living in the most polluted areas.

The proposal for spatial averaging is based on a finding that many of the community-based epidemiological studies used spatial averages or monitoring sites representing community-wide exposures to PM2.5. U.S. EPA considers a regional average to be appropriate in setting a standard and in determining whether the standard is attained. This approach is not supported by the body of health studies. Only a few studies actually averaged PM2.5 data from multiple monitors, and other studies that used a single monitor do not provide significant evidence that the selected sites represent appropriate spatial averages for each region studied.

The general effect of spatial averaging is to reduce the protectiveness of the annual standard in those areas within a spatial averaging zone that experience high concentrations more regularly than the other areas. To safeguard protectiveness to some degree, the proposal suggests limits on how spatial averaging would be applied. In the proposed amendments to Part 58 (accompanying the proposal for the new PM NAAQS), U.S. EPA offers guidelines for spatial averaging that would limit the scope of a spatial averaging zone. However, the proposed guidelines would allow annual concentrations at the most polluted sites to exceed the spatial average by up to 20 percent.

REFERENCES

Dockery, D. W.; Speizer, F. E.; Stram, D. O.; Ware, J. H.; Spengler, J. D.; Ferris, B. G., Jr. (1989) Effects of inhalable particles on respiratory health of children. Am. Rev. Respir. Dis. 139: 587-594.

Gordian, M. E.; Ozkaynak, H.; Xue, J.; Morris, S. S.; Spengler, J. D. (1996) Particulate air pollution and respiratory disease in Anchorage, Alaska. Environ. Health Perspect. 104: 209-297.

Hefflin, B. J.; Jalaludin, B.; McClure, E.; Cobb, N.; Johnson, C. A.; Jecha, L.; Etzel, R. A. (1994) Surveillance for dust storms and respiratory disease in Washington State, 1991. Arch. Environ. Health. 49: 170-174.

Schwartz, J.; Dockery, D. W.; Neas, L. M.; Wypij, D.; Ware, J. H.; Spengler, J. D.; Koutrakis, P.; Speizer, F. E.; Ferris, B. G., Jr. (1994) Acute effects of summer air pollution on respiratory symptom reporting in children. Am. J. Respir. Crit. Care Med. 150: 1234-1242.